ABSTRACT OF THE DISCLOSURE

General algorithms are developed for reconstructing the acoustic field generated by an arbitrary object subject to an arbitrarily time-dependent excitation. These algorithms enable one to visualize a time-domain acoustic pressure wave as it travels through three-dimensional space. Such a tool can be used to diagnose general noise sources and transmission since in engineering applications most structures are subject to arbitrarily time-dependent excitations. To facilitate the derivations of the temporal solutions, we make use of Laplace transform and expand the acoustic pressure in terms of the spherical Hankel functions and the spherical harmonics. The expansion coefficients are settled by solving an over-determined system of equations obtained by matching the assumed-form solutions to the measured acoustic pressures. To obtain a general expression for a temporal kernel, we replace the spherical Hankel functions by polynomials in s, recast the infinite integral in the inverse Laplace transform as a contour integral in the complex s-plane, and evaluate it via residue theorem. Once this is done, the transient acoustic quantities anywhere including a source surface can be obtained by convoluting the temporal kernels with respect to measured acoustic pressures.